of math and mechanical ability. Customer service and interpersonal skills are also important. Because the work entails climbing and other physical activity, applicants should have stamina, coordination, and must be unafraid of heights. The ability to distinguish colors is necessary because wires and cables may be coded by color.

Line installers and repairers working for electric power companies generally complete formal apprenticeship or employer training programs. These are sometimes administered jointly by the employer and the union representing the workers. The unions include the International Brotherhood of Electrical Workers, the Communications Workers of America, and the Utility Workers Union of America. Apprenticeship programs last several years and combine formal instruction with on-the-job training.

Line installers and repairers in telephone and cable television companies receive several years of on-the-job training. They may also attend training provided by equipment manufacturers, schools, or industry training organizations. The Society of Cable Television Engineers (SCTE) provides certification programs for line installers and repairers. Applicants for certification must be employed in the cable television industry, and attend training sessions at local SCTE chapters.

Entry-level line installers may be hired as groundmen, helpers, or tree trimmers, who clear branches from telephone and power lines. These workers may advance to positions stringing cable and performing service installations. With experience, they may advance to more sophisticated maintenance and repair positions responsible for increasingly larger portions of the network. Promotion to supervisory or training positions is also possible.

Job Outlook

Overall employment of line installers and repairers is expected to grow about as fast as the average for all occupations through 2008. Much of this increase will result from growth in the telecommunications industry. The introduction of new technologies, such as fiber optic cable, has increased the transmission capacity of telephone and cable television networks. This higher capacity has allowed the creation of new and extremely popular services, such as high-speed Internet access. At the same time, deregulation of the telecommunications industry has reduced barriers to competition. As a result, companies from a variety of industries are installing high capacity networks in order to compete for the increasing demand for telecommunications services. Mergers among highly competitive communications and electrical power companies may result in layoffs; however, these will be offset by growth due to the expansion of telecommunications networks. Besides employment growth, many job openings will result from the need to replace the large number of older workers reaching retirement age.

Employment of telephone and cable television line installers and repairers is expected to grow faster than average. Telephone and cable television companies will create new networks and expand existing ones to provide customers with high-speed access to data, video, and graphics. Line installers and repairers will be needed not only to construct and install networks, but also to maintain the ever-growing systems of wires and cables. Businesses will install extensive private networks as they increasingly use telecommunications lines for access to suppliers and customers. Residential customers will request additional lines to their houses in order to use telephone and Internet communications simultaneously.

The distribution of electrical power has not undergone the same transformation as has occurred in telecommunications, and the need for network expansion is not as great. As a result, the overall employment of electrical powerline installers and repairers should experience little or no growth. However, job openings will arise from the need to replace workers who retire or leave the occupation. Because electrical power companies have reduced hiring and training in recent years, opportunities should be best for workers who possess experience and training.

Earnings

Median hourly earnings for electrical powerline installers and repairers were $20.48 in 1998. The middle 50 percent earned between $16.30 and $23.90. The lowest 10 percent earned less than $11.54 and the highest 10 percent earned more than $33.32. Median hourly earnings in the industries employing the largest numbers of electrical powerline installers and repairers in 1997 are shown below.

Combination utility services	$23.60
Electrical services	20.00
Telephone communications	19.80
Electrical work	17.00
Heavy construction, except highway and street	14.10

Median hourly earnings for telephone and cable television line installers and repairers were $15.75 in 1998. The middle 50 percent earned between $10.97 and $21.42. The lowest 10 percent earned less than $8.85 and the highest 10 percent earned more than $24.54. Median hourly earnings in the industries employing the largest numbers of telephone and cable television line installers and repairers in 1997 are shown below.

Telephone communications	$19.90
Electrical work	12.30
Cable and other pay television services	11.60
Heavy construction, except highway and street	10.60

Most line installers and repairers belong to unions, principally the Communications Workers of America, the International Brotherhood of Electrical Workers, and the Utility Workers Union of America. For these workers, union contracts set wage rates, wage increases, and the time needed to advance from one step to the next.

Related Occupations

Related skilled craft positions include broadcast and sound technicians; electricians; and telecommunications equipment mechanics, installers, and repairers.

Sources of Additional Information

For more details about employment opportunities, contact the telephone, cable television, or electrical power company in your community. For general information on line installer and repairer jobs, write to:

☛ Communications Workers of America, 501 3rd St. NW., Washington, DC 20001.

☛ International Brotherhood of Electrical Workers, Utility Department, 1125 15th St. NW., Washington, DC 20005.

For general information on line installers and repairers and other power plant occupations, write to:

☛ Utility Workers Union of America, 815 16th St. NW., Washington, DC 20006.

For information on training and certification programs in the cable industry, contact:

☛ Society of Cable Telecommunications Engineers, Certification Department, 140 Philips Road, Exton, PA 19341.
Internet: **http://www.scte.org**

Maintenance Mechanics, General Utility

(O*NET 85119C and 85132)

Significant Points

- Most general maintenance mechanics are trained on the job; others learn by working as helpers to other repairers or construction workers such as carpenters, electricians, or machinery repairers.

- Despite slower-than-average employment growth resulting from advancements in machinery, job openings should be plentiful due to significant turnover in this large occupation.

Nature of the Work

Most craft workers specialize in one kind of work such as plumbing or carpentry. General maintenance mechanics, however, have skills in many different crafts. They repair and maintain machines, mechanical equipment, and buildings, and work on plumbing, electrical, and air-conditioning and heating systems. They build partitions, make plaster or drywall repairs, and fix or paint roofs, windows, doors, floors, woodwork, and other parts of building structures. They also maintain and repair specialized equipment and machinery found in cafeterias, laundries, hospitals, stores, offices, and factories. Typical duties include troubleshooting and fixing faulty electrical switches, repairing air-conditioning motors, and unclogging drains. New buildings sometimes have computer-controlled systems, requiring mechanics to acquire basic computer skills. For example, new air conditioning systems often can be controlled from a central computer terminal. Additionally, light sensors can be electronically controlled to automatically turn off lights after a set amount of time.

General maintenance mechanics inspect and diagnose problems and determine the best way to correct them, often checking blueprints, repair manuals, and parts catalogs. They obtain supplies and repair parts from distributors or storerooms. They use common hand and power tools such as screwdrivers, saws, drills, wrenches, and hammers, as well as specialized equipment and electronic testing devices. They replace or fix worn or broken parts, where necessary, or make adjustments.

General maintenance mechanics routinely perform preventive maintenance and ensure that machines continue to run smoothly.

These mechanics also do routine preventive maintenance and ensure that machines continue to run smoothly, building systems operate efficiently, and the physical condition of buildings does not deteriorate. Following a checklist, they may inspect drives, motors, and belts, check fluid levels, replace filters, and perform other maintenance actions. Maintenance mechanics keep records of maintenance and repair work.

Mechanics in small establishments, where they are often the only maintenance worker, do all repairs except for very large or difficult jobs. In larger establishments, their duties may be limited to the general maintenance of everything in a workshop or a particular area.

Working Conditions

General maintenance mechanics often do several different tasks in a single day, at any number of locations. They may work inside of a single building or in several different buildings. They may have to stand for long periods, lift heavy objects, and work in uncomfortably hot or cold environments, in awkward and cramped positions, or on ladders. They are subject to electrical shock, burns, falls, cuts, and bruises. Most general maintenance workers work a 40-hour week. Some work evening, night, or weekend shifts, or are on call for emergency repairs.

Those employed in small establishments, where they may be the only maintenance worker, often operate with only limited supervision. Those working in larger establishments often are under the direct supervision of an experienced worker.

Employment

General maintenance mechanics held over 1.2 million jobs in 1998. They were employed in almost every industry. Around 35 percent worked in service industries, mainly in elementary and secondary schools, colleges and universities, hotels, and hospitals and nursing homes. About 16 percent worked in manufacturing industries. Others worked for wholesale and retail firms, government agencies, and real estate firms that operate office and apartment buildings.

Training, Other Qualifications, and Advancement

Most general maintenance mechanics learn their skills informally on the job. They start as helpers, watching and learning from skilled maintenance workers. Helpers begin by doing simple jobs such as fixing leaky faucets and replacing light bulbs, and progress to more difficult tasks such as overhauling machinery or building walls.

Others learn their skills by working as helpers to other repair or construction workers such as carpenters, electricians, or machinery repairers. Necessary skills can also be learned in high school shop classes and postsecondary trade or vocational schools. It generally takes from 1 to 4 years of on-the-job training or school, or a combination of both, to become fully qualified, depending on the skill level required. Because a growing proportion of new buildings rely on computers to control building systems, general maintenance mechanics may need basic computer skills—how to log on to a central computer system and navigate through a series of menus. Usually companies that install computer-controlled equipment provide on-site training for general maintenance mechanics.

Graduation from high school is preferred for entry into this occupation. High school courses in mechanical drawing, electricity, woodworking, blueprint reading, science, mathematics, and computers are useful. Mechanical aptitude, ability to use shop math, and manual dexterity are important. Good health is necessary because the job involves much walking, standing, reaching, and heavy lifting. Difficult jobs require problem-solving ability, and many positions require the ability to work without direct supervision.

Many general maintenance mechanics in large organizations advance to maintenance supervisor or to one of the crafts such as electrician, heating and air-conditioning mechanic, or plumber. Within small organizations, promotion opportunities are limited.

Job Outlook
Job openings should be plentiful. General maintenance mechanics is a large occupation with significant turnover, and many job openings should result from the need to replace workers who transfer to other occupations or stop working for other reasons.

Employment of general maintenance mechanics is expected to grow more slowly than the average for all occupations through 2008. Employment is related to the number of buildings—for example, office and apartment buildings, stores, schools, hospitals, hotels, and factories—and the amount of equipment needing maintenance and repair. As machinery becomes more advanced, however, the need for general mechanics diminishes.

Earnings
Median hourly earnings of general maintenance mechanics were $11.20 in 1998. The middle 50 percent earned between $8.43 and $14.99. The lowest 10 percent earned less than $6.56 and the highest 10 percent earned more than $18.83. Median hourly earnings in the industries employing the largest numbers of general maintenance mechanics in 1997 are shown below:

Local government, except education and hospitals	$11.90
Hospitals	11.30
Real estate agents and managers	9.80
Real estate operators and lessors	9.40
Hotels and motels	8.20

Some general maintenance mechanics are members of unions, including the American Federation of State, County, and Municipal Employees; and the United Automobile Workers.

Related Occupations
Some duties of general maintenance mechanics are similar to those of carpenters, plumbers, industrial machinery repairers, electricians, and heating, air-conditioning, and refrigeration mechanics.

Sources of Additional Information
Information about job opportunities may be obtained from local employers and local offices of the State Employment Service.

Millwrights

(O*NET 85123A and 85123B)

Significant Points

- Training generally lasts 4 to 5 years—through apprenticeship programs that combine on-the-job training with classroom instruction—or through community college coupled with informal on-the-job training.
- Although employment is projected to decline slightly, skilled applicants should have good job opportunities.
- About 58 percent belong to labor unions, one of the highest rates of membership in the economy.

Nature of the Work
Millwrights install, repair, replace, and dismantle the machinery and heavy equipment used in many industries. Responsibilities require a wide range of skills—from blueprint reading and pouring concrete to diagnosing and solving mechanical problems.

The millwright's responsibilities begin when machinery arrives at the job site. New equipment must be unloaded, inspected, and moved into position. To lift and move light machinery, millwrights use rigging and hoisting devices, such as pulleys and cables. In other cases, they require the assistance of hydraulic lift-truck or crane operators to position the machinery. Because millwrights often decide which device to use for moving machinery, they must know the load-bearing properties of ropes, cables, hoists, and cranes.

Millwrights consult with production managers and others to determine the optimal placement of machines in a plant. In some instances, this placement requires building a new foundation. Millwrights either prepare the foundation themselves or supervise its construction, so they must know how to read blueprints and work with building materials, such as concrete, wood, and steel.

When assembling machinery, millwrights fit bearings, align gears and wheels, attach motors, and connect belts, according to the manufacturer's blueprints and drawings. Precision leveling and alignment are important in the assembly process; millwrights must have good mathematical skills, so they can measure angles, material thickness, and small distances with tools such as squares, calipers, and micrometers. When a high level of precision is required, devices such as lasers and ultrasonic measuring tools may be used. Millwrights also work with hand and power tools, such as cutting torches, welding machines, and soldering guns. Some of these workers use metalworking equipment, such as lathes or grinders to modify parts to specifications.

In addition to installing and dismantling machinery, many millwrights repair and maintain equipment. This includes preventive maintenance, such as lubrication and fixing or replacing worn parts. (For further information on machinery maintenance, see the statement on industrial machinery repairers elsewhere in the *Handbook*.)

Increasingly sophisticated automation means more complicated machines for millwrights to install and maintain. For example, millwrights

When assembling machinery, millwrights fit bearings, align gears and wheels, attach motors, and connect belts according to the manufacturer's specifications.